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# Research on the License Plate Recognition based on MATLAB

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## Abstract

The license plate image pre-processing which aims to improve the image quality and protrude the outstanding information that we need, which is favourable to the subsequent processing including character segmentation and positioning, character recognition, is significant in the license plate recognition system. First of all, we convert the colour image obtained into a gray-scale image by using histogram equalization, then get rid of the noise through self-adaptive median filter to improve the image quality, and the gray-scale image is stretched to enhance the image contrast. Above all, image is sharpened by using Log-Prewitt operator which does not aim at light intensity directly, but light strong logarithm (light density). to enhance the edge information of the image. It is a new method of Prewitt edge detection with detection boundary area. With light intensity irrelevant, anti-jamming is strong, processing speed is quick and it is suitable for online detection. The experiment results show that the pre-processing method is perfect.

**Key words:** gray-scale tensile; Log-Prewitt operator; self-adaptive median filter

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## 1. Introduction

License Automatic Identification (LAI) is one of the key technologies that can realize modernization and intelligent traffic. At the same time, License plate recognition is the significant component of Intelligent Transform System (ITS). License Plate is the important symbol of the vehicle characteristics. So research of the License Plate System has the important significance for realizing the modernization of

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traffic management. License plate identification system includes five parts: vehicle images acquisition, license plate pre-processing, license plate character segmentation and positioning, character recognition. This paper studies the pre-treatment of the vehicle images. The image is affected by the interference factors, such as illumination, climate and background, which has an effect on the subsequent license plate Identification.

## 2. License Plate Image of gray

Usually the License Plate image attained by the digital camera and constituted by 24 bits of true colour image, which consists of three components including red, green and blue, then through the deployment of 3-component, the predecessors divide it into 256 levels from 0 to 255. In a word, there are  $256 * 256 * 256 = 16777216$  kinds of colour images, which are composed of R, G, B three monochrome different combination. Colour image species are plentiful. If the colour image documents are processed directly, they will require a lot of system space, which has an effect on the speed of image processing. Based on system performance consideration, at present, the majority of photo identification systems adopt gray image of excluding colour information in the image processing. Gray image does not contain colour information, but contains only brightness information. Which is favourable to image processing. Therefore, we should convert the colour image into gray image before image processing. Usually only is quantification divided into 256 level (0 to 255). 0 stands for completely black, while 255 represents all white, each pixel of gray scale image only needs a 8-bit bytes to show the pixel luminance values. Gray conversion according to gray values and the corresponding relation, RGB colour general formula is as follows:

$$Y = 0.299 R + 0.587 G + 0.114B$$

(1)

Y in formula stands for white brightness. Gray image is as shown in fig. 2.



Fig. 1. Original image



Fig. 2. Gray image

## 3. The adaptive median filter of vehicle images

Images can be added some noise during the photographic process or transmission, which affects the quality of the images. Performing the self-adaptive median filter can get rid of these noises, at the same time, it can realize the smooth. Usually the methods of image noise eliminated contain field average method, self-adaptive median filter method. The paper adopts the self-adaptive median filter method. Because the field average method gets rid of the noise, simultaneously it can also make some details of

the images blurred. However, the self-adaptive median filter can get rid of the noise when it can keep the image's details unchanged and will prevent edge blur.

Self-adaptive median filter is a kind of typical nonlinear filtering. First of all, we should identify a maximum window size of self-adaptive median filter, image's gray value in the position  $(x, y)$  is  $f(x, y)$ , while image's gray value in the corresponding position  $(x, y)$  is  $g(x, y)$ . The formula is as follows:

$$g(x, y) = \text{adpmedian}\{f(x, y), S_{\max}\}$$

(2)

Where  $S_{\max}$  is the size of the window.

The window size has directly relation with the smooth effect the size of the window, which must ensure noise eliminated, meanwhile it can protect image's edges information. Here the window size selected is 7. Using the MATLAB image processing function processes the image shown in the Fig. 3.



Fig. 3. Result of Self-adaptive median filter

#### 4. The vehicle images gray stretch

While underexposure has made the whole image darken, overexposure has all the images brighten, which causes the image details of the resolution unclear. In order to enhance vehicle images contrast, make image trenchant, clear, light and shade, and have graphic features obvious, which is helpful for image recognition. Firstly, we need Linear gray transform for gray image, in order to highlight the license plate parts. The transformation equations adopted generally in linear stretching is as follow:

$$g(x, y) = f(x, y) * C + R \quad (3)$$

An output image grey value of dynamic range determines the value of C, R. Gray transformation formula for eight gray image is as follow :

$$g(x, y) = \begin{cases} 0 & f(x, y) < f_{\min} \\ \frac{f(x, y) - f_{\min}}{f_{\max} - f_{\min}} \times 255 & f_{\min} \leq f(x, y) < f_{\max} \\ 255 & f(x, y) \geq f_{\max} \end{cases} \quad (4)$$



Fig. 4. Result of grey stretch

Where  $f(x, y)$  represents the grey scale value of the original grey scale image, while  $g(x, y)$  in the formula stands for the grey scale value of grey transformation. The experiment results show that when  $f(x, y)_{\min} = 25$  and  $f(x, y)_{\max} = 130$ , grey stretch effect is very perfect. Not only can it improve the quality of the license plate area and enhance the contrast of license plate area, but also it benefits to the

edge extraction of follow-up license plate. Using MATLAB image processing toolbox processed image which is shown in the Fig. 4.

## 5. Vehicle images gradient sharpening

The image of sharpening aims to make gray scale contrast enhancement, which enhances the image edge information and is beneficial to the extraction of outline. Because outline or edge is the largest image gray-scale rate place. Therefore, in order to find out the outline, we must find a way to search the place of the biggest gray image. Image information usually concentrates on the place, where the pixel changes fiercely, and its pixel presents nonlinear variation in the image edges. Image gradient reflects changes between the image pixels in size, it is a differential process. In discrete image processing, we adapt pixels worth "errand" instead of pixel values of the derivation. Gradient calculation based on Sobel algorithm (based on first-order differential), and Laplacian algorithm (based on the first order differential), and Roberts algorithm, and Prewitt algorithm and so on. These algorithms aim at the light intensity of the image. Laplacian algorithm (based on the first order differential), Roberts algorithm, Prewitt algorithm, these algorithms for image are the light intensity. This article uses the Log-Prewitt algorithm, which does not aim at light intensity directly, but light strong logarithm (light density). It is a new method of Prewitt edge detection with detection boundary area. With light intensity irrelevant, anti-jamming is strong, processing speed is quick and it is suitable for online detection.

Log-Prewitt algorithm adopts the convolution kernels Prewitt algorithm. Its just object is not image gray-scale, but the logarithm of gray-scale, so the original algorithm can retain strong light changes not sensitive, and through the smooth advantages of resistance to overcome the shortcomings, improve signal-to-noise ratio.

The computation formula is as follows:

$$A = (\log(g(x+1, y-1)) + \log(g(x+1, y)) + \log(g(x+1, y+1))) - (\log(g(x-1, y-1)) + \log(g(x-1, y)) + \log(g(x-1, y+1))) \quad (5)$$

$$B = (\log(g(x-1, y+1)) + \log(g(x, y+1)) + \log(g(x+1, y+1))) - (\log(g(x-1, y-1)) + \log(g(x, y-1)) + \log(g(x-1, y+1))) \quad (6)$$

$$G(x, y) = |A| + |B| \quad (7)$$

The image processed by Using MATLAB image processing function is shown in fig. 5.



Fig. 5. Result of sharpening by Log-Prewitt operator

## 6. Conclusions

License plate image pre-processing is the basic step in license plate recognition system. Processing results will have a direct impact on the following-up work of the license plate identification system. Gray stretch effectively enhances the license plate images and license image contrast. This paper adopts a kind of innovative way --- Log\_Prewitt operator that is used to sharpen image. It effectively improves image edge information of license plate. This method is better than Robert operator, and Sobel operator and

Prewitt operator. At the same time, the effect is very apparent; And the self- adaptive median filter adopted is more effective than any other method to eliminate noise and prevent edge information of the license blurred, which has laid a solid foundation for the following-up work of vehicle plate recognition system.

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